Science Tutorials offer targeted instruction, practice, and review designed to help students develop scientific literacy, deepen conceptual understanding, and apply scientific practices. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By continually honing their ability to apply knowledge in real-world scenarios, students build the depth of knowledge and higher-order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students as they explore the nature of science through focused content, interactive mini investigations, multi-modal representations, and personalized feedback. The Review It offers a high-impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

These Tutorials are built to state standards.

### Unit 1: Nature of Science

- **WHAT IS SCIENCE?**
  - ES.1.a.1: The student will demonstrate an understanding of scientific and engineering practices by asking questions and defining problems ask questions that arise from careful observation of phenomena, examination of a model or theory, or unexpected results, and/or to seek additional information
  - ES.1.a.3: The student will demonstrate an understanding of scientific and engineering practices by asking questions and defining problems generate hypotheses based on research and scientific principles
  - ES.1.a.5: The student will demonstrate an understanding of scientific and engineering practices by asking questions and defining problems define design problems that involve the development of a process or system with multiple components and criteria
  - ES.1.d.5: The student will demonstrate an understanding of scientific and engineering practices by constructing and critiquing conclusions and explanations differentiate between a scientific hypothesis, theory, and law
- **TYPES OF INVESTIGATIONS**
  - ES.1.a.2: The student will demonstrate an understanding of scientific and engineering practices by asking questions and defining problems determine which questions can be investigated within the scope of the school laboratory or field experience


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- ES.1.a.4: The student will demonstrate an understanding of scientific and engineering practices by asking questions and defining problems make hypotheses that specify what happens to a dependent variable when an independent variable is manipulated
- ES.1.b.1: The student will demonstrate an understanding of scientific and engineering practices by planning and carrying out investigations individually and collaboratively plan and conduct observational and experimental investigations

## Unit 2: Measurement and Data

- **TOOLS AND MEASUREMENT**
  - ES.1.b.3: The student will demonstrate an understanding of scientific and engineering practices by planning and carrying out investigations select and use appropriate tools and technology to collect, record, analyze, and evaluate data
  - ES.1.c.5: The student will demonstrate an understanding of scientific and engineering practices by interpreting, analyzing, and evaluating data analyze data using tools, technologies, and/or models in order to make valid and reliable scientific claims or determine an optimal design solution
- **DISPLAYING AND INTERPRETING DATA**
  - ES.1.c.1: The student will demonstrate an understanding of scientific and engineering practices by interpreting, analyzing, and evaluating data construct and interpret data tables showing independent and dependent variables, repeated trials, and means
  - ES.1.c.2: The student will demonstrate an understanding of scientific and engineering practices by interpreting, analyzing, and evaluating data construct, analyze, and interpret graphical displays of data and consider limitations of data analysis
  - ES.1.c.3: The student will demonstrate an understanding of scientific and engineering practices by interpreting, analyzing, and evaluating data apply mathematical concepts and processes to scientific questions
  - ES.1.d.1: The student will demonstrate an understanding of scientific and engineering practices by constructing and critiquing conclusions and explanations make quantitative and/or qualitative claims based on data
  - ES.1.f.1: The student will demonstrate an understanding of scientific and engineering practices by obtaining, evaluating, and communicating information compare, integrate, and evaluate sources of information presented in different media or formats to address a scientific question or solve a problem
  - ES.1.f.2: The student will demonstrate an understanding of scientific and engineering practices by obtaining, evaluating, and communicating information gather, read, and evaluate scientific and/or technical information from multiple sources, assessing the evidence and credibility of each source
  - ES.1.f.3: The student will demonstrate an understanding of scientific and engineering practices by obtaining, evaluating, and communicating information communicate scientific and/or technical information about phenomena and/or a design process in multiple formats

## Unit 3: Working with Models


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- **USING MODELS**
  - ES.1.c.4: The student will demonstrate an understanding of scientific and engineering practices by interpreting, analyzing, and evaluating data use data in building and revising models, supporting explanations of phenomena, or testing solutions to problems
  - ES.1.c.5: The student will demonstrate an understanding of scientific and engineering practices by interpreting, analyzing, and evaluating data analyze data using tools, technologies, and/or models in order to make valid and reliable scientific claims or determine an optimal design solution
  - ES.1.e.1: The student will demonstrate an understanding of scientific and engineering practices by developing and using models evaluate the merits and limitations of models
  - ES.1.e.2: The student will demonstrate an understanding of scientific and engineering practices by developing and using models develop, revise, and/or use models based on evidence to illustrate or predict relationships
  - ES.1.e.3: The student will demonstrate an understanding of scientific and engineering practices by developing and using models construct and interpret scales, diagrams, classification charts, graphs, tables, imagery, models, including geologic cross sections and topographic profiles
- **MODELS OF EARTH**
  - ES.1.e.3: The student will demonstrate an understanding of scientific and engineering practices by developing and using models construct and interpret scales, diagrams, classification charts, graphs, tables, imagery, models, including geologic cross sections and topographic profiles
  - ES.1.e.4: The student will demonstrate an understanding of scientific and engineering practices by developing and using models read and interpret topographic and basic geologic maps and globes, including location by latitude and longitude

## Unit 4: Exploring the Universe

- **THE UNIVERSE**
  - ES.2.a: The student will demonstrate an understanding that there are scientific concepts related to the origin and evolution of the universe. Key ideas include the big bang theory explains the origin of universe;
  - ES.2.b: The student will demonstrate an understanding that there are scientific concepts related to the origin and evolution of the universe. Key ideas include stars, star systems, and galaxies change over long periods of time;
- **OUR SUN AND OTHER STARS**
  - ES.2.b: The student will demonstrate an understanding that there are scientific concepts related to the origin and evolution of the universe. Key ideas include stars, star systems, and galaxies change over long periods of time;
  - ES.2.c: The student will demonstrate an understanding that there are scientific concepts related to the origin and evolution of the universe. Key ideas include characteristics of the sun, planets and their moons, comets, meteors, asteroids, and dwarf planets are determined by materials found in each body; and


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- **SPACE EXPLORATION**
  - ES.2.d: The student will demonstrate an understanding that there are scientific concepts related to the origin and evolution of the universe. Key ideas include evidence from space exploration has increased our understanding of the structure and nature of our universe.

## Unit 5: The Solar System

- **SUN-EARTH-MOON SYSTEM**
  - ES.3.b: The student will investigate and understand that Earth is unique in our solar system. Key ideas include the dynamics of the sun Earth moon system cause seasons, tides, and eclipses.
- **OUR SOLAR SYSTEM**
  - ES.2.b: The student will demonstrate an understanding that there are scientific concepts related to the origin and evolution of the universe. Key ideas include stars, star systems, and galaxies change over long periods of time;
  - ES.2.c: The student will demonstrate an understanding that there are scientific concepts related to the origin and evolution of the universe. Key ideas include characteristics of the sun, planets and their moons, comets, meteors, asteroids, and dwarf planets are determined by materials found in each body; and
  - ES.3.a: The student will investigate and understand that Earth is unique in our solar system. Key ideas include Earth supports life because of its relative proximity to the sun and other factors; and

## Unit 6: The Geosphere

- **MINERALS**
  - ES.4.a: The student will investigate and understand that there are major rock forming and ore minerals. Key ideas include analysis of physical and chemical properties supports mineral identification;
  - ES.4.b: The student will investigate and understand that there are major rock forming and ore minerals. Key ideas include characteristics of minerals determine the uses of minerals; and
  - ES.4.c: The student will investigate and understand that there are major rock forming and ore minerals. Key ideas include minerals originate and are formed in specific ways.
- **THE ROCK CYCLE**
  - ES.5.a: The student will investigate and understand that igneous, metamorphic, and sedimentary rocks can transform. Key ideas include Earth materials are finite and are transformed over time;
  - ES.5.b: The student will investigate and understand that igneous, metamorphic, and sedimentary rocks can transform. Key ideas include the rock cycle models the transformation of rocks;
  - ES.5.c: The student will investigate and understand that igneous, metamorphic, and sedimentary rocks can transform. Key ideas include layers of Earth have rocks with specific chemical and physical properties; and
  - ES.5.d: The student will investigate and understand that igneous, metamorphic, and sedimentary rocks can transform. Key ideas include plate tectonic and surface processes transform Earth


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materials.

### Unit 7: Understanding Soil

- **WEATHERING AND EROSION**
  - ES.8.a: The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include water influences geologic processes including soil development and karst topography;
- **SOIL**
  - ES.8.a: The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include water influences geologic processes including soil development and karst topography;

### Unit 8: The Atmosphere, Hydrosphere, and Cryosphere

- **FRESHWATER AND ICE**
  - ES.8.a: The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include water influences geologic processes including soil development and karst topography;
  - ES.8.b: The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include the nature of materials in the subsurface affect the water table and future availability of fresh water;
  - ES.8.c: The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include weather and human usage affect freshwater resources, including water locations, quality, and supply; and
- **OCEANS**
  - ES.10.a: The student will investigate and understand that oceans are complex, dynamic systems and are subject to long and short term variations. Key ideas include chemical, biological, and physical changes affect the oceans;
  - ES.10.b: The student will investigate and understand that oceans are complex, dynamic systems and are subject to long and short term variations. Key ideas include environmental and geologic occurrences affect ocean dynamics;
  - ES.10.c: The student will investigate and understand that oceans are complex, dynamic systems and are subject to long and short term variations. Key ideas include unevenly distributed heat in the oceans drives much of Earths weather;
  - ES.10.d: The student will investigate and understand that oceans are complex, dynamic systems and are subject to long and short term variations. Key ideas include features of the sea floor reflect tectonic and other geological processes; and
  - ES.10.e: The student will investigate and understand that oceans are complex, dynamic systems and are subject to long and short term variations. Key ideas include human actions, including economic and public policy issues, affect oceans and the coastal zone including the Chesapeake Bay.


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- **THE ATMOSPHERE**
  - ES.11.a: The student will investigate and understand that the atmosphere is a complex, dynamic system and is subject to long and short term variations. Key ideas include the composition of the atmosphere is critical to most forms of life;
  - ES.11.b: The student will investigate and understand that the atmosphere is a complex, dynamic system and is subject to long and short term variations. Key ideas include biologic and geologic interactions over long and short time spans change the atmospheric composition;
  - ES.11.c: The student will investigate and understand that the atmosphere is a complex, dynamic system and is subject to long and short term variations. Key ideas include natural events and human actions may stress atmospheric regulation mechanisms; and

## Unit 9: Weather and Climate

- **WEATHER**
  - ES.10.c: The student will investigate and understand that oceans are complex, dynamic systems and are subject to long and short term variations. Key ideas include unevenly distributed heat in the oceans drives much of Earths weather;
  - ES.12.a: The student will investigate and understand that Earths weather and climate are the result of the interaction of the suns energy with the atmosphere, oceans, and the land. Key ideas include weather involves the reflection, absorption, storage, and redistribution of energy over short to medium time spans;
  - ES.12.b: The student will investigate and understand that Earths weather and climate are the result of the interaction of the suns energy with the atmosphere, oceans, and the land. Key ideas include weather patterns can be predicted based on changes in current conditions;
  - ES.12.d: The student will investigate and understand that Earths weather and climate are the result of the interaction of the suns energy with the atmosphere, oceans, and the land. Key ideas include models based on current conditions are used to predict weather phenomena; and
- **SEVERE WEATHER**
  - ES.12.c: The student will investigate and understand that Earths weather and climate are the result of the interaction of the suns energy with the atmosphere, oceans, and the land. Key ideas include extreme imbalances in energy distribution in the oceans, atmosphere, and the land may lead to severe weather conditions;
  - ES.12.d: The student will investigate and understand that Earths weather and climate are the result of the interaction of the suns energy with the atmosphere, oceans, and the land. Key ideas include models based on current conditions are used to predict weather phenomena; and
- **CLIMATE**
  - ES.8.c: The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include weather and human usage affect freshwater resources, including water locations, quality, and supply; and


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- ES.11.c: The student will investigate and understand that the atmosphere is a complex, dynamic system and is subject to long and short term variations. Key ideas include natural events and human actions may stress atmospheric regulation mechanisms; and
- ES.11.d: The student will investigate and understand that the atmosphere is a complex, dynamic system and is subject to long and short term variations. Key ideas include human actions, including economic and policy decisions, affect the atmosphere.
- ES.12.e: The student will investigate and understand that Earths weather and climate are the result of the interaction of the suns energy with the atmosphere, oceans, and the land. Key ideas include changes in the atmosphere and the oceans due to natural and human activity affect global climate.

## Unit 10: Our Changing Planet

- **DEFORMING EARTH'S CRUST**
  - ES.5.d: The student will investigate and understand that igneous, metamorphic, and sedimentary rocks can transform. Key ideas include plate tectonic and surface processes transform Earth materials.
- **PLATE TECTONICS**
  - ES.7.a: The student will investigate and understand that plate tectonic theory explains Earths internal and external geologic processes. Key ideas include convection currents in Earths interior lead to the movement of plates and influence the distribution of materials in Earths layers, and may impact the magnetic field;
  - ES.7.b: The student will investigate and understand that plate tectonic theory explains Earths internal and external geologic processes. Key ideas include features and processes occur within plates and at plate boundaries;
  - ES.7.c: The student will investigate and understand that plate tectonic theory explains Earths internal and external geologic processes. Key ideas include interaction between tectonic plates causes the development of mountain ranges and ocean basins; and
- **GEOLOGIC TIME**
  - ES.1.d.2: The student will demonstrate an understanding of scientific and engineering practices by constructing and critiquing conclusions and explanations construct and revise explanations based on valid and reliable evidence obtained from a variety of sources, including students own investigations, models, theories, simulations, and peer review
  - ES.9.a: The student will investigate and understand that many aspects of the history and evolution of Earth and life can be inferred by studying rocks and fossils. Key ideas include traces and remains of ancient, often extinct, life are preserved by various means in sedimentary rocks;
  - ES.9.b: The student will investigate and understand that many aspects of the history and evolution of Earth and life can be inferred by studying rocks and fossils. Key ideas include superposition, cross cutting relationships, index fossils, and radioactive decay are methods of dating rocks and Earth events and processes;


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- ES.9.c: The student will investigate and understand that many aspects of the history and evolution of Earth and life can be inferred by studying rocks and fossils. Key ideas include absolute (radiometric) and relative dating have different applications but can be used together to determine the age of rocks and structures; and

## Unit 11: Humans and Earth's Resources

- **NATURAL RESOURCES**
  - ES.1.d.3: The student will demonstrate an understanding of scientific and engineering practices by constructing and critiquing conclusions and explanations apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena or design solutions
  - ES.1.d.4: The student will demonstrate an understanding of scientific and engineering practices by constructing and critiquing conclusions and explanations construct arguments or counterarguments based on data and evidence
  - ES.6.a: The student will investigate and understand that resource use is complex. Key ideas include global resource use has environmental liabilities and benefits;
  - ES.6.b: The student will investigate and understand that resource use is complex. Key ideas include availability, renewal rates, and economic effects are considerations when using resources;
  - ES.6.d: The student will investigate and understand that resource use is complex. Key ideas include all energy sources have environmental and economic effects.
- **IMPACTS OF HUMANS**
  - ES.1.b.2: The student will demonstrate an understanding of scientific and engineering practices by planning and carrying out investigations plan and conduct investigations to test design solutions in a safe and ethical manner including considerations of environmental, social and personal effects
  - ES.6.a: The student will investigate and understand that resource use is complex. Key ideas include global resource use has environmental liabilities and benefits;
  - ES.6.b: The student will investigate and understand that resource use is complex. Key ideas include availability, renewal rates, and economic effects are considerations when using resources;
  - ES.6.d: The student will investigate and understand that resource use is complex. Key ideas include all energy sources have environmental and economic effects.
  - ES.8.b: The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include the nature of materials in the subsurface affect the water table and future availability of fresh water;
  - ES.10.e: The student will investigate and understand that oceans are complex, dynamic systems and are subject to long and short term variations. Key ideas include human actions, including economic and public policy issues, affect oceans and the coastal zone including the Chesapeake Bay.
  - ES.11.d: The student will investigate and understand that the atmosphere is a complex, dynamic system and is subject to long and short term variations. Key ideas include human actions, including economic and policy decisions, affect the atmosphere.


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- ES.12.e: The student will investigate and understand that Earths weather and climate are the result of the interaction of the suns energy with the atmosphere, oceans, and the land. Key ideas include changes in the atmosphere and the oceans due to natural and human activity affect global climate.


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